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ABSTRACT

This document contains the course syllabus and 12 independent practice modules for a college pre-calculus course designed as the second course in a two-semester sequence for students in a Bachelor of Technology program. The course emphasizes applications from technology and verbal problems. Topics include trigonometric functions; identities; graphs of the trigonometric functions; functions of a composite angle; DeMoivre's theorem; inequalities; logarithms; binominal theorem; and Cramer's rule. Information given in the syllabus includes: (1) text; (2) grading criteria; (3) course description; (4) course procedures; (5) behavioral objectives; and (6) course outline. (CW)

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NEW YORK INSTITUTE OF TECHNOLOGY
CENTER FOR THE NATURAL SCIENCES
DEPARTMENT OF MATHEMATICS

COURSE OUTLINE

MATH 3320 - TECHNICAL MATHEMATICS II

PREREQUISITE: MATH 3310 OR EQUIVALENT

INSTRUCTOR:_____ OFFICE TELEPHONE:_____

OFFICE LOCATION:_____ OFFICE HOURS:_____

GRADING CRITERIA:

Exams (3)	48%
Quizzes	12
Homework Modules	12
Final (departmental and comprehensive)	28
	100%

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No one will be exempted from the final exam. The final exam grade itself must be higher than 40, regardless of the quiz/exam average, in order to pass the course.

COURSE DESCRIPTION:

Math 3320 is the second course in the integrated sequence in mathematics for students in the Bachelor of Technology program. The two courses, 3310 and 3320, may also be used for students in a Bachelor of Science program, dependent upon the placement exam score, as a prerequisite for 3022. Topics include trigonometric functions, identities, graphs of the trigonometric functions, functions of a composite angle, DeMoivre's theorem, inequalities, logarithms, binomial theorem and Cramer's Rule. Applications drawn from technology. Verbal problems emphasized throughout.

BEHAVIORAL OBJECTIVES:

By completion of the course sequence 3310-3320, the student should have a firm grasp of the skills and concepts in algebra, trigonometry, logarithmic and exponential functions which are needed for success in subsequent mathematics courses, especially calculus.

TEXTBOOK:

BASIC TECHNICAL MATHEMATICS, Peter K.F. Kuhfitting, Brooks/Cole Publishing, 1984.

REFERENCE:

ALGEBRA AND TRIGONOMETRY: A FUNCTIONS APPROACH, Keedy and Bittinger, Third Edition, Addison-Wesley Publishing Co.

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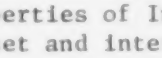
Rev. 6/87

NEW YORK INSTITUTE OF TECHNOLOGY
CENTER FOR THE NATURAL SCIENCES
DEPARTMENT OF MATHEMATICS

MATH 3320: Technical Mathematics II*
TEXTBOOK: Basic Technical Mathematics, Peter K.F. Kuhfitting, Brooks/Cole Publishing, 1984.

MODULE	SECTION	TOPIC	PROBLEMS
1	4.1-5	Review - Intro to Trigonometry	pp.146-148: 4,7,10,13,18,20,22, 24,26,32,33,41,47,50
	7.1	Algebraic Signs of Trig Functions	pp.228-229: 4,9,14,17,20,23
2	7.2	Special Angles	p.234: 2,10,18,26,34,39,43,48, 56,64,67,75
	7.3	Trig Functions of Arbitrary Angles	p.238: 2,3,4,20,24,31,34,43
	7.4	Radians (incl. Trig. Fcns. of Angles in Rdn.)	p.243: 9-12,19,21,33-36,41,46, $\cos\frac{4\pi}{3}$, $\tan\frac{\pi}{2}$, $\sin(-\frac{3\pi}{4})$, $\cot\frac{7\pi}{6}$
3	7.5	App'ns. of Radian Measure	p.247: 2,4,9,14,15
	8.1	Graphs of Sine and Cosine Fcns. (incl. domain and range of ea.)	p.257: 2,3,8,11,22
	8.2	Phase Shifts	p.260: 1,2,7,8,17
	8.4	Graphs of Other Trig. Fcns. (incl. domain and range of ea.)	p.269: 3,7,9,17,18
4	16.1	Fundamental Identities	p.493: Column 2
	16.2	Proving Identities	pp.497-498: 6,9,12,15,18,21,24,30,35
5	16.3	Sum and Difference Formulas	pp.503-505: 2,7,10,12,16,22,25,43,46
	16.4	Double-Angle Formulas	pp.509-510: 3,7,14,16,18,26,29,32
	16.5	Half-Angle Formulas	pp.514-515: 1,2,9,10,12,15,19,27
6	9.4	Law of Sines	pp.289-290: 1,8,9,10,23,24
	9.5	Law of Cosines	pp.295-296: 4,7,12,15,19
7	11.1	Complex Numbers	p.337: 2,4,5,10,25,28
	11.2	Comp. Nos. - Fundamental Operations	pp.340-342: 5,8,9,14,22,30,33,44, 48-60(even)
	11.3	Polar Form (omit exponential form)	p.345: 4,8,11,15,28,29,33,36,37,39, 43,45
8	18.3	Binomial Theorem (incl. Specific Term)	p.572: 6,7,9,12,13,18,19, fourth term of $(x-2)^7$, third term $(3y+\sqrt{x})^8$, middle term $(y-2x)^6$
	14.1,2	Remainder and Factor Theorems	p.422: 7,8,11,20,25,26
9	14.3	Synthetic Division	p.427: 4,7,12,13,25,28,33,41,43
	14.4	Fundamental Theorem of Algebra	p.431: 4,5,13,17,31,32
	14.5	Rational Roots	pp.438-439: 1,2,5,8,15,18
10	17.1	Basic Properties of Inequalities (incl. set and interval notation)	Write interval notation for:  , $\{x \mid -.5 < x \leq 9\}$ Write set notation for: $[c,d)$, $[6,8\pi]$ p.538: Col. 2
	17.2	More inequalities	p.543: 1,5,6,7,10,14,18,19,22

MODULE	SECTION	TOPIC	PROBLEMS
11	17.3	Absolute Value Inequalities	p.547: 3,4,6,9,11,12
	12.1	Definition of Logarithm	pp.360-361: 3,4,7,8,19,20,23,24, 38,43,47,49
	12.2	Graphs of Exp. and Log Functions	p.365: 2,5,9
12	12.3	Properties of Logarithms	pp.369-370: 3,6,9,12,15,21,30,42, 45,51,58,61,64
	12.4	Common Logarithms	p.374: 2,3,5,6,12,13,14
	12.5	Computations with Logarithms	p.376: 4,10,13
	12.6	Natural Logarithms, Change of Base	p. 379: 1,4,5,8
	12.7	Exponential and Logarithmic Eqns.	pp.383-384: 2,7,13,14,17

This outline divides the semesters' work into twelve modules, each of approximately one weeks length. The terms' remaining time is for additional lesson hours, if need be, exams and review.

The indicated problems and the module exercises give both the teacher and the student guidelines concerning the types and breadth of problems to be covered. These problems can be assigned and/or used for in-class demonstration.

*All faculty teaching 3320 are to familiarize themselves with the current 3011 text (Algebra and Trigonometry: A Functions Approach, Fourth Edition, Keedy and Bittinger) to assure that depth and breadth of topics and question types are equivalent.

1. Change to decimal form: $35^\circ 40'$

   a) 35.4° b) 35.0° c) 36.0° d) 35.7° e) 35.6°

2. Change to degrees and minutes, to the nearest $10'$, 75.2°:

   a) $75^\circ 20'$ b) $75^\circ 00'$ c) $75^\circ 10'$ d) $75^\circ 12'$ e) $75^\circ 2'$

3. Find the smallest positive angle coterminal with -380°:

   a) 20° b) 340° c) 160° d) 380° e) -20°

For questions #4 through #6, use a diagram to determine the exact value of the trigonometric function.

4. $\cos 45^\circ =$

   a) $\frac{\sqrt{2}}{2}$ b) $\sqrt{2}$ c) $\frac{\sqrt{3}}{2}$ d) $\frac{1}{2}$ e) none of these

5. $\tan 60^\circ =$

   a) $\frac{\sqrt{3}}{2}$ b) $\sqrt{3}$ c) $\frac{\sqrt{3}}{3}$ d) $\frac{1}{3}$ e) none of these

6. $\csc 90^\circ =$

   a) 1 b) 0 c) -1 d) $\frac{1}{2}$ e) undefined

For questions #7 and #8, find the smallest positive angle satisfying the given equation.

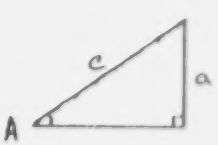
7. $\sin \theta = \frac{\sqrt{3}}{2}$

   a) 30° b) 45° c) 60° d) 90° e) none of these

8. $\tan \theta = 1$

   a) 30° b) 45° c) 60° d) 90° e) none of these

9. Given $A = 38^\circ 10'$ and $c = 508.7$ ft., find a.



   a) 399.9 ft. b) 314.4 ft. c) 399.8 ft. d) 823.2 ft.
   e) 647.0 ft.

For questions #10 through #12, find the given function for an angle θ in standard position whose terminal side passes through the given point.

10. Passes through $(\sqrt{3},1)$; $\sin \theta =$

    a) $\frac{\sqrt{3}}{3}$ b) $\sqrt{3}$ c) $\frac{1}{2}$ d) $\frac{\sqrt{3}}{2}$ e) 1

11. Passes through $(-2,2)$; $\cos\theta =$

a) $2\sqrt{2}$ b) $\sqrt{2}$ c) $\frac{\sqrt{2}}{2}$ d) -1 e) none of these

12. Passes through $(-3,-5)$; $\csc\theta =$

a) $-\frac{5}{\sqrt{34}}$ b) $-\frac{\sqrt{34}}{5}$ c) -5 d) $\frac{\sqrt{34}}{5}$ e) none of these

13. Given the angle θ in the diagram, then $\tan\theta =$

a) $-\frac{3}{\sqrt{5}}$

b) $\frac{3}{\sqrt{5}}$

c) $\pm\frac{3}{\sqrt{5}}$

d) $\pm\frac{\sqrt{5}}{3}$

e) $-\frac{\sqrt{5}}{3}$

14. Given the angle θ in the diagram, then $\sec\theta =$

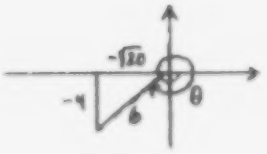
a) $-\frac{\sqrt{5}}{3}$

b) $\frac{3}{\sqrt{5}}$

c) $-\frac{3}{\sqrt{5}}$

d) $\pm\frac{3}{\sqrt{5}}$

e) $-\frac{3}{2}$



15. Consider the diagram where the point P is in the third quadrant. Which of the following is <u>false</u>?

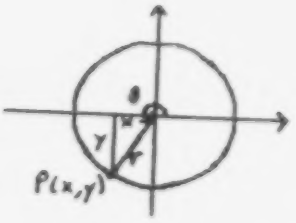
a) x is a negative number

b) y is a negative number

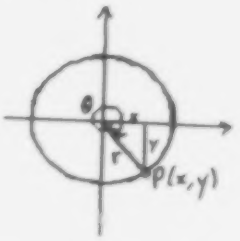
c) $\sin\theta = \frac{y}{r}$

d) r is a positive number

e) r is a negative number



16. Consider the diagram where the point P is in the fourth quadrant. Which of the following is false?



a) cos θ is a positive number

b) tan θ is a negative number

c) $\cos\theta = \frac{x}{r}$

d) r is a positive number

e) $\sec\theta = \frac{r}{y}$

17. If $\sin\theta = \frac{1}{2}$ and θ lies in quadrant I, then find $\cos\theta$:

a) $\frac{\sqrt{3}}{3}$ b) $-\frac{\sqrt{3}}{2}$ c) $\frac{\sqrt{3}}{2}$ d) $\sqrt{3}$ e) none of these

18. If $\tan\theta = 4$ and θ lies in quadrant I, find $\sin\theta$:

a) $\frac{1}{4}$ b) $\frac{4}{\sqrt{17}}$ c) $\frac{1}{\sqrt{17}}$ d) 4 e) none of these

19. Given that $\cot\theta = -\frac{4}{3}$ and that θ is in the second quadrant, the value of $\csc\theta$ is:

a) $\frac{5}{3}$ b) $-\frac{5}{3}$ c) $-\frac{3}{5}$ d) $-\frac{5}{4}$ e) $-\frac{4}{5}$

20. Given $\cot\theta < 0$ and $\tan\theta < 0$, find the quadrant in which θ lies:

a) I b) II c) III d) IV e) not enough information given

21. Given $\sec\theta > 0$, which of the following is impossible?

a) $\sin\theta < 0$ b) $\tan\theta < 0$ c) $\cos\theta < 0$ d) $\cot\theta < 0$

e) any of the above conditions are possible

22. If $\csc\theta = -\frac{5}{4}$ and $\cos\theta < 0$, find $\tan\theta$:

a) $\frac{4}{3}$ b) $-\frac{3}{4}$ c) $-\frac{4}{3}$ d) $\frac{3}{4}$ e) none of these

23. A 20.0 ft. ladder leans against the side of a house. The angle between the ground and ladder is 70.0°. How far from the house is the foot of the ladder?

a) 58.5 ft. b) 18.8 ft. c) 54.9 ft. d) 6.8 ft. e) 21.3 ft.

24. The angle of elevation of the sun is $48^\circ 0'$ at the time a television tower casts a shadow 346 ft. long on level ground. Find the height of the tower.

a) 232 ft. b) 257 ft. c) 384 ft. d) 312 ft. e) 466 ft.

25. A flagpole is atop a building. From a point on the ground 720.0 ft. from the building, the angles of elevation of the top and bottom of the flagpole are $33^\circ 30'$ and $31^\circ 10'$, respectively. How tall is the flagpole?

a) 24.8 ft. b) 476.6 ft. c) 397.4 ft. d) 435.5 ft. e) 41.1 ft.

1. $\tan 120^\circ =$

   a) $\frac{\sqrt{2}}{2}$ b) $-\frac{1}{\sqrt{3}}$ c) $\frac{1}{\sqrt{3}}$ d) $\sqrt{3}$ e) $-\sqrt{3}$

2. $\sin(-390^\circ) =$

   a) $-\frac{1}{2}$ b) $\frac{1}{2}$ c) 1 d) 0 e) does not exist

3. $\cos 840^\circ =$

   a) 2 b) -2 c) $\frac{1}{2}$ d) $-\frac{1}{2}$ e) $-\frac{2}{\sqrt{3}}$

For questions #4 through #7, find all θ for the given value of the trigonometric function. $(0^\circ \leq \theta < 360^\circ)$

4. $\cot \theta = 1$

   a) $\theta = 45^\circ$ b) $\theta = 135^\circ$ c) $\theta = 45^\circ$ and $\theta = 315^\circ$
   d) $\theta = 45^\circ$ and $\theta = 135^\circ$ e) $\theta = 45^\circ$ and $\theta = 225^\circ$

5. $\csc \theta = 2$

   a) $\theta = 150^\circ$ and $\theta = 210^\circ$ b) $\theta = 30^\circ$ and $\theta = 210^\circ$ c) $\theta = 30^\circ$ and $\theta = 150^\circ$
   d) $\theta = 30^\circ$ e) $\theta = 30^\circ$, $\theta = 150^\circ$, $\theta = 210^\circ$ and $\theta = 330^\circ$

6. $\cos \theta = -\frac{1}{2}$

   a) $\theta = 120^\circ$ and $\theta = 240^\circ$ b) $\theta = 120^\circ$ c) $\theta = 60^\circ$ and $\theta = 120^\circ$
   d) $\theta = 120^\circ$ and $\theta = 300^\circ$ e) $\theta = 60^\circ$, $\theta = 120^\circ$, $\theta = 240^\circ$ and $\theta = 300^\circ$

7. $\sec \theta$ undefined

   a) $\theta = 0^\circ$ b) $\theta = 90^\circ$ c) $\theta = 180^\circ$ d) $\theta = 90^\circ$ and $\theta = 180^\circ$
   e) $\theta = 90^\circ$ and $\theta = 270^\circ$

8. Convert 495° to radian measure in terms of π

   a) $\frac{3\pi}{4}$ b) $\frac{11\pi}{5}$ c) $-\frac{5\pi}{4}$ d) $\frac{5\pi}{4}$ e) $\frac{11\pi}{4}$

9. Convert -300° to radian measure in terms of π

   a) $\frac{5\pi}{3}$ b) $\frac{\pi}{3}$ c) $\frac{5\pi}{6}$ d) $-\frac{5\pi}{3}$ e) $-\frac{\pi}{3}$

10. Convert 4 radians to degree measure (to the nearest degree)

    a) 12° b) 229° c) 720° d) 240° e) 1440°

11. Convert $\frac{5\pi}{12}$ to degree measure

a) 75° b) $\frac{5^\circ}{4}$ c) 150° d) 225° e) none of these

12. Convert $-\frac{7\pi}{2}$ to degree measure

a) 90° b) 630° c) 270° d) -270° e) -630°

For questions #13 and #14, use a trigonometric table or calculator to find the value of each of the given trigonometric functions.

13. $\sin 309^\circ 50' =$

a) -0.6406 b) 0.6406 c) -0.7679 d) 0.7679 e) -0.7642

14. $\sec(-60^\circ 10') =$

a) 2.010 b) -2.010 c) -1.153 d) 1.153 e) 1.990

For questions #15 and #16, use a trigonometric table or calculator to find all angles θ such that $0^\circ \leq \theta < 360^\circ$.

15. $\tan \theta = -1.653$

a) $58^\circ 50'$ and $188^\circ 50'$ b) $121^\circ 10'$ and $301^\circ 10'$ c) $58^\circ 50'$ and $121^\circ 10'$
d) $148^\circ 50'$ and $328^\circ 50'$ e) $121^\circ 10'$ and $138^\circ 50'$

16. $\cos \theta = 0.8718$

a) $29^\circ 20'$ and $330^\circ 40'$ b) $29^\circ 20'$ and $209^\circ 20'$ c) $29^\circ 20'$ and $150^\circ 40'$
d) $29^\circ 20'$ e) $29^\circ 20'$, $150^\circ 40'$, $209^\circ 20'$ and $330^\circ 40'$

17. $\tan(-\frac{\pi}{2}) =$

a) 0 b) 1 c) -1 d) does not exist e) none of these

18. $\sec \frac{3}{4}\pi =$

a) $\frac{\sqrt{2}}{2}$ b) $\sqrt{2}$ c) $-\frac{\sqrt{2}}{2}$ d) $-\sqrt{2}$ e) none of these

19. $\cot(-\frac{3\pi}{2}) =$

a) 1 b) -1 c) 0 d) does not exist e) none of these

20. $\csc(-\frac{\pi}{6}) =$

a) $\frac{1}{2}$ b) $\frac{2}{\sqrt{3}}$ c) -2 d) $-\frac{2}{\sqrt{3}}$ e) 2

21. $\tan \frac{5\pi}{3}$ =

a) $\sqrt{3}$ b) $-\sqrt{3}$ c) $\frac{1}{\sqrt{3}}$ d) $-\frac{1}{\sqrt{3}}$ e) does not exist

22. $\tan(-\frac{7}{3}\pi)$ =

a) $-\frac{1}{\sqrt{3}}$ b) $\frac{1}{\sqrt{3}}$ c) $\sqrt{3}$ d) $-\sqrt{3}$ e) -1

23. $\cot(-7\pi)$ =

a) 0 b) 1 c) does not exist d) $-\sqrt{2}$ e) none of these

24. $\sec \frac{15\pi}{4}$ =

a) $\frac{\sqrt{2}}{2}$ b) $\sqrt{2}$ c) does not exist d) $-\sqrt{2}$ e) none of these

25. $\csc(-\frac{17\pi}{6})$ =

a) 2 b) $\frac{1}{2}$ c) does not exist d) $-\frac{1}{2}$ e) -2

1. An arc of 5 in., on a circle of radius 15 in., subtends an angle of how many radians?

   a) 75 b) $\frac{1}{10}$ c) 3 d) $\frac{1}{3}$ e) 10

2. An arc 25 cm. long on a circle of radius 10 cm. subtends an angle of how many degrees, to the nearest degree?

   a) 8° b) 23° c) 143° d) 450° e) 3°

3. Find the length of an arc, to the nearest hundredth, of a circle, given a central angle of 135° and a radius of 3 cm. (Use 3.14 for π).

   a) 12.56 cm. b) 14.14 cm. c) 2.25 cm. d) 405.00 cm.
   e) 7.07 cm.

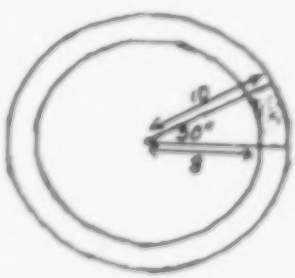
4. A pendulum 3.0 ft. long oscillates through an angle of 5.0°. Find the distance through which the end of the pendulum swings in going from one extreme position to the other. (Use 3.14 for π).

   a) 15.0 ft. b) 0.09 ft. c) 0.39 ft. d) 0.26 ft. e) 859.87 ft.

5. Find the area of a sector of a circle, given that the central angle is 120° and the diameter is 24 cm.

   a) 192π cm^2 b) 48π cm^2 c) 144π cm^2 d) 8,640 cm^2 e) 96π cm^2

6. Two concentric circles have radii of 8 in. and 10 in. Find the shaded area, in the diagram, for a central angle of 30°.



   a) 0.33π in^2
   b) 6π in^2
   c) 540 in^2
   d) 3π in^2
   e) none of these

7. The period of the cosine function is:

   a) π b) $-\pi$ c) 2π d) -2π e) does not exist

8. The amplitude of the sine function is:

   a) -1 b) 0 c) any real number d) 1 e) none of these

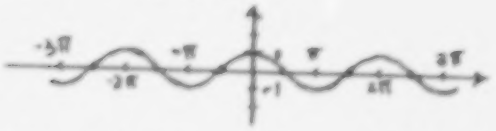
9. What is the period of this function?

   a) 3.14 b) 1 c) -1 d) -3.14 e) 6

10. The period of the cotangent function is:

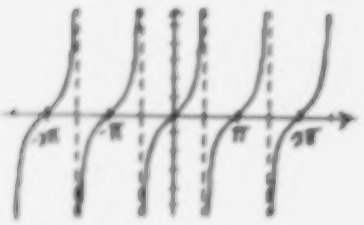
a) 1 b) -1 c) any real number d) π e) $-\pi$

11. The following is the graph of:



a) $y = \sin x$ b) $y = \csc x$ c) $y = \sec x$ d) $y = \cos x$
e) $y = \tan x$

12. The following is the graph of:



a) $y = \sin x$
b) $y = \csc x$
c) $y = \sec x$
d) $y = \cos x$
e) $y = \tan x$

13. What is the range of the cosine function?

a) all reals greater than 2π b) all reals from -1 to 1, inclusive
c) all reals except -1 to 1 d) all reals e) none of these

14. What is the domain of the tangent function?

a) all reals except between -1 and 1 b) all reals except $k\pi$, k any integer
c) all reals except $\frac{\pi}{2} + k\pi$, k any integer d) all reals
e) there is no domain

Given: $y = -2 \cos \frac{x}{3}$

15. What is the amplitude of the function?

a) $\frac{1}{3}$ b) 3 c) -2 d) 2 e) there is none

16. What is the period of the function?

a) $\frac{1}{3}\pi$ b) $\frac{2\pi}{3}$ c) 6π d) -2 e) 2

Given: $y = -\cot(2x - \frac{\pi}{2})$

17. What is the amplitude of the function?

a) 1 b) -1 c) 2 d) $-\frac{1}{2}$ e) there is none

18. What is the period of the function?

a) 2π b) π c) $\frac{\pi}{2}$ d) $-\frac{\pi}{2}$ e) there is none

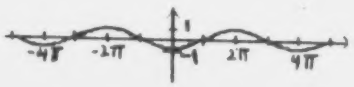
19. What is the phase shift of the function?

a) $\frac{\pi}{4}$ b) $-\frac{\pi}{2}$ c) π d) $\frac{\pi}{2}$ e) $-\frac{\pi}{4}$

20. If $y = \frac{1}{3}\sin 3\pi x$, then the period is:

a) $\frac{3}{2}\pi$ b) $\frac{2\pi}{3}$ c) $\frac{1}{3}$ d) $\frac{2}{3}$ e) 3π

21. Given:



This a sketch of the graph of:

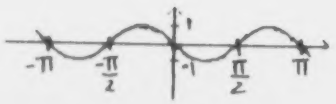
a) $y = \cos 2x$ b) $y = \sin 2x$ c) $y = \sec \frac{1}{2}x$

d) $y = -\sin \frac{1}{2}x$ e) $y = -\cos \frac{1}{2}x$

22. Sketch a graph of $y = \sin(2x - \pi)$

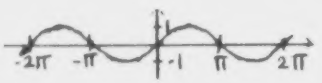
a)

b)



c)

d)

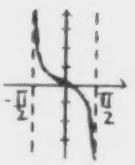


e) none of these

23. Sketch a graph of $y = -\tan \frac{1}{2}x$

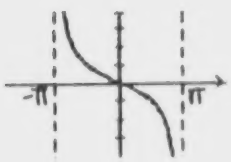
a)

b)



c)

d)



e)

24. Determine the value of c so that the period of $y = \frac{1}{2} \sin cx$ will be $\frac{\pi}{2}$.

a) 4 b) 2 c) $\frac{\pi}{2}$ d) $\frac{2}{\pi}$ e) $\frac{1}{2}$

25. Determine the value of c so that the period of $y = 2 \cot cx$ will be 4π.

a) 4 b) 2 c) 4π d) $\frac{1}{4}$ e) $\frac{1}{2}$

Find the equivalent expression.

1. $\dfrac{1 + \tan^2 x}{\sec^2 x} =$

   a) $\cos^2 x + \tan^2 x$ b) 1 c) $1 + \sin^2 x$ d) $1 + \dfrac{\tan^2 x}{\sec^2 x}$

   e) $\dfrac{1 + \sin^2 x}{\sec^2 x \cos^2 x}$

2. $\cos^2 x + \cot^2 x + \sin^2 x =$

   a) $\csc^2 x$ b) $2\cos^2 x + \sin^2 x$ c) $\tan^2 x$ d) $\dfrac{2\cos^2 x + \sin^4 x}{\sin^2 x}$

   e) $\dfrac{\sin^2 x \cos^2 x + \sin^2 x}{\sin^2 x}$

3. $\dfrac{\cos^2 x - 1}{\cos^2 x} =$

   a) $\tan^2 x$ b) -1 c) $-\cot^2 x$ d) $\cot^2 x$ e) $-\tan^2 x$

4. $\dfrac{\sec t}{\csc t} =$

   a) 1 b) $\cot t$ c) 0 d) $\tan t$ e) none of these

5. $\tan^2\theta - \sin^2\theta =$

   a) $(\sin\theta \tan\theta)^2$ b) $\sin^2\theta \cot^2\theta$ c) $-\sin^4\theta$ d) $\sin^4\theta$

   e) $1 - \cot^2\theta \sin^2\theta$

6. $\csc^2\left(\frac{3\pi}{2}\right) - 1 =$

   a) $\cot^2 \frac{3\pi}{2}$ b) $\tan^2 \frac{3\pi}{2}$ c) $\sin^2 \frac{3\pi}{2}$ d) $\cos^2 \frac{3\pi}{2}$ e) $\sec^2 \frac{3\pi}{2}$

7. $\sqrt{1 - \cos^2\theta} =$

   a) $1 - \cos\theta$ b) $\sec\theta$ c) $\sqrt{\cos^2\theta}$ d) $|\sin\theta|$ e) $\sin\theta$

8. Express tan x in terms of sec x

   a) $\tan x = \pm\sqrt{\sec^2 x + 1}$ b) $\tan x = \pm\sqrt{1 - \sec^2 x}$

   c) $\tan x = \pm\sqrt{\sec^2 x - 1}$ d) $\tan x = \sec x - 1$ e) $\tan x = \pm\sqrt{1 - \csc^2 x}$

Find the equivalent expression.

9. $\dfrac{\sin^2\theta + \cos^2\theta}{\sin^2\theta} =$

   a) $\sin^2\theta + \cot^2\theta$ b) $\cos^2\theta$ c) $\sec^2\theta$ d) $1 + \cos^2\theta$ e) $\csc^2\theta$

10. $\dfrac{\sec^2 w - \tan^2 w}{\sec^2 w} =$

a) $1 - \tan^2 w$ b) $\cos^2 w$ c) $-\tan^2 w$ d) $\sin^2 w$ e) none of these

11. $\cos\theta\,(\cos\theta - \sec\theta) =$

a) $\cos^2\theta - \sec\theta$ b) $2\cos\theta - \sec\theta$ c) $2\cos\theta - 1$ d) $\sin^2\theta$
e) $-\sin^2\theta$

12. $\dfrac{\cos x - \sin x}{\cos x} =$

a) $1 - \sin x$ b) $\cos x - \tan x$ c) $-\tan x$ d) $1 - \tan x$
e) none of these

13. $\tan y(\tan y + \cot y) =$

a) $\tan^2 y$ b) $\sec^2 y$ c) $\tan y + 1$ d) $\csc^2 y$ e) $\tan^2 y + \cot y$

14. $\dfrac{1 + \cos x}{\sin x} + \dfrac{\sin x}{\cos x} =$

a) $\dfrac{1 + \cos x}{\sin x \cos x}$ b) $\dfrac{2}{\sin x \cos x}$ c) $\dfrac{1}{\sin x \cos x}$ d) $\dfrac{1 + \cos x + \sin x}{\sin x + \cos x}$
e) 1

15. $\dfrac{\sin x}{1 - \cos x} + \dfrac{1 - \cos x}{\sin x} =$

a) 2 b) $\dfrac{2}{(1 - \cos x)\sin x}$ c) $\sin x + \cos^2 x$ d) $\dfrac{2}{\sin x}$ e) 1

16. $\sin y(\csc y - \sin y) =$

a) $1 - \sin y$ b) 0 c) $\cos^2 y$ d) $\sin^2 y$ e) $1 + \sin^2 y$

17. $\sin^2\theta \cot^2\theta + \sin^2\theta =$

a) $\sin^2\theta \cot^2\theta$ b) 1 c) $\sin^2\theta \sec^2\theta$ d) $\sin^4\theta \cot^2\theta$
e) $2\sin^2\theta \cot^2\theta$

18. $\sin x + \dfrac{\cos^2 x}{\sin x} =$

a) $\sin x + \tan x$ b) $\cos^2 x$ c) $\csc x$ d) $\dfrac{\sin x + \cos^2 x}{\sin x}$
e) $\sin x + \tan^2 x$

19. $\tan^4\theta + \tan^2\theta =$

a) $\tan^6\theta$ b) $\dfrac{1}{\cos^2\theta}$ c) $\tan^2\theta \sec^2\theta$ d) $\sec^2\theta$ e) $\sec^4\theta$

20. $\sin^3 x + \sin x \cos^2 x =$

a) 1 b) $\sin x$ c) $2 \sin x$ d) $\sin x \cos x$ e) none of these

21. $(\sin x - \cos x)^2 =$

a) 1 b) 0 c) $1 - 2 \sin x \cos x$ d) $-2 \sin x \cos x$
e) $\sin^2 x - \cos^2 x$

22. $\dfrac{\cos^2 \theta}{1 + \sin\theta} =$

a) $1 - \sin\theta$ b) 1 c) $\dfrac{1 - \sin\theta}{2}$ d) $-\sin\theta$ e) $1 + \sin\theta$

23. $\dfrac{1}{\csc x - \cot x} =$

a) $\csc x + \tan x$ b) $\csc x - \cot x$ c) $\csc x - \tan x$ d) 1
e) $\csc x + \cot x$

24. $\dfrac{\sin x}{1 - \cos x} =$

a) $1 - \tan x$ b) $\dfrac{1}{\sin x}$ c) $\dfrac{1 + \cos x}{\sin x}$ d) $\dfrac{1 - \cos x}{\sin x}$ e) 1

25. $\dfrac{\tan\theta}{\sec\theta + 1} =$

a) $\sec\theta - 1$ b) $\sec\theta + 1$ c) 1 d) $\sec\theta - \cot\theta$
e) $\csc\theta - \cot\theta$

1. Use $75^\circ = 45^\circ + 30^\circ$ and the appropriate formula to find $\sin 75^\circ$.

   a) $\frac{\sqrt{2}+1}{2}$ b) $\frac{\sqrt{6}+\sqrt{2}}{4}$ c) $\frac{\sqrt{6}-\sqrt{2}}{4}$ d) $\frac{\sqrt{2}-1}{2}$ e) $\frac{\sqrt{8}}{4}$

Write as a single term.

2. $\sin 75^\circ \cos 5^\circ - \cos 75^\circ \sin 5^\circ$

   a) $\cos 80^\circ$ b) 0 c) $\sin 80^\circ$ d) $\sin 70^\circ$ e) none of these

3. $\cos 2x \cos 3x - \sin 2x \sin 3x$

   a) $-\sin x$ b) $\cos x$ c) $\cos 5x$ d) $-\cos x$ e) none of these

4. $\cos(a + b) \cos(a - b) + \sin(a + b) \sin(a - b)$

   a) $\cos 2a$ b) $\sin 2a$ c) $\sin 2b$ d) $\cos 2b$ e) none of these

5. Evaluate without tables or a calculator: $\sin 72^\circ \cos 12^\circ - \cos 72^\circ \sin 12^\circ$

   a) $\frac{\sqrt{3}}{2}$ b) $\frac{1}{2}$ c) $\sin 84^\circ$ d) $\cos 84^\circ$ e) none of these

6. Simplify: $\sin(\alpha + \beta) - \sin(\alpha - \beta)$

   a) $2\cos\alpha \sin\beta$ b) $2\sin\beta$ c) 0 d) $\sin 2\beta$ e) $-2\sin\alpha \sin\beta$

7. Simplify: $\frac{\sin(x + y)}{\cos x \cos y}$

   a) $\tan x \tan y$ b) $\frac{\tan x}{\cos y} + \frac{\tan y}{\cos x}$ c) $\cot x + \cot y$ d) $\tan x + \tan y$

   e) none of these

8. Simplify: $2\sin 25^\circ \cos 25^\circ$

   a) $\sin 12.5^\circ$ b) $2\sin 12.5^\circ$ c) $2\sin 50^\circ$ d) $\cos 50^\circ$ e) $\sin 50^\circ$

9. Evaluate without tables or a calculator: $1 - 2\sin^2 75^\circ$

   a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $-\frac{\sqrt{3}}{2}$ d) $\cos 37.5^\circ$ e) $\frac{3}{4}$

10. Simplify: $\cos^2 3x - \sin^2 3x$

    a) $\cos 6x$ b) -1 c) $3\cos 2x$ d) $2\cos 3x$ e) $\cos \frac{3}{2} x$

11. $4\sin 6x \cos 6x =$

    a) $\sin 24x$ b) $12\sin 2x$ c) $8\sin 12x$ d) $4\sin 12x$ e) $2\sin 12x$

For questions #12 and #13, let θ be an angle in quadrant III such that $\sin\theta = -\frac{3}{5}$.

12. Find $\sin 2\theta$

a) $\frac{4}{5}$ b) $\frac{6}{5}$ c) $\frac{24}{25}$ d) $\frac{24}{5}$ e) $-\frac{24}{25}$

13. Find $\cos 2\theta$

a) $\frac{6}{5}$ b) $-\frac{7}{25}$ c) $\frac{8}{5}$ d) 1 e) $\frac{7}{25}$

For questions #14 through #16, let θ be an angle in quadrant IV such that $\cos\theta = \frac{1}{3}$.

14. Find $\cos 2\theta$

a) $-\frac{4}{3}\sqrt{2}$ b) $-\frac{2}{3}\sqrt{2}$ c) $\frac{7}{9}$ d) $-\frac{7}{9}$ e) $\frac{2}{3}$

15. Find $\sin 2\theta$

a) $\frac{4}{9}\sqrt{2}$ b) $-\frac{4}{9}\sqrt{2}$ c) $-\frac{7}{9}$ d) $\frac{\sqrt{2}}{3}$ e) $\frac{4}{3}\sqrt{2}$

16. Find $\sin(\theta + 60^\circ)$

a) $-\frac{2}{3}\sqrt{2} + \frac{\sqrt{3}}{2}$ b) $-\frac{2}{3}\sqrt{2} + \frac{\pi}{3}$ c) $\frac{-2\sqrt{2} + \sqrt{3}}{6}$ d) $\frac{-4\sqrt{6}}{6}$ e) $\frac{\sqrt{2} - 4}{6}$

Find an equivalent expression.

17. $\frac{\sin 2y}{2\sin^2 y}$

a) $\frac{1}{2}$ b) $\cot y$ c) $\frac{1}{\sin y}$ d) $\sec y$ e) none of these

18. $\frac{2\tan x}{\sin 2x}$

a) $\sec^2 x$ b) $\frac{2}{\cos x}$ c) $\cos^2 x$ d) $\frac{\tan x}{\sin x}$ e) none of these

19. $\frac{1 - \cos 2x}{\sin 2x}$

a) $\tan x$ b) 0 c) $-\cot x$ d) $\frac{1 + \cos x}{\sin x}$ e) none of these

20. Which of the following is <u>true</u> for all real numbers x ?

a) $\sin 3x = 3\sin x$ b) $\cos 2x = 2\cos^2 x - 1$ c) $\cos\frac{x}{2} = \frac{1}{2}\cos x$

d) $\sin^4 x + \cos^4 x = 1$ e) $\cos^2 x - \sin^2 x = -1$

21. If $\sin\theta = \frac{5}{13}$ and θ is in quadrant I, find $\sin\frac{\theta}{2}$.

a) $\frac{5}{26}$ b) $\frac{120}{169}$ c) $\frac{2}{\sqrt{13}}$ d) $\frac{1}{\sqrt{26}}$ e) $\frac{10}{13}$

22. If $\cos\theta = \frac{8}{17}$ and θ is in quadrant IV, find $\cos\frac{\theta}{2}$.

a) $\frac{5}{\sqrt{34}}$ b) $-\frac{5}{\sqrt{34}}$ c) $-\frac{1}{\sqrt{17}}$ d) $-\frac{3}{\sqrt{34}}$ e) $-\frac{4}{\sqrt{17}}$

23. Simplify: $2\cos^2\frac{x}{2} =$

a) $\cos^2 x$ b) $1 + \cos x$ c) $2\cos x$ d) $\cos x$ e) $2 + 2\cos x$

Use the appropriate formula to eliminate the exponent.

24. $2\sin^2 x$

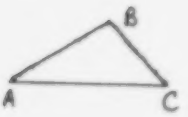
a) $1 - \cos 2x$ b) $4\sin x$ c) $\sin x$ d) $1 + \cos 2x$ e) $\frac{1 - \cos 2x}{2}$

25. $\cos^2 4x$

a) $2(1 + \cos 2x)$ b) $\cos 16x$ c) $2(1 + \cos 8x)$ d) $\frac{1 + \cos 8x}{2}$

e) $2\cos 4x$

1. In triangle ABC, $A = 35^\circ$, $C = 50^\circ$ and $c = 6.0$ cm. Therefore, $a =$



a) $\sin 50^\circ/6.0 \sin 35^\circ$
b) $6.0 \sin 35^\circ/\sin 50^\circ$
c) $6.0 \sin 50^\circ/\sin 35^\circ$
d) $\sin 35^\circ/6.0 \sin 50^\circ$
e) none of these

2. In triangle ABC, $a = 15$, $c = 7$ and $B = 62^\circ$. Which equation will determine b^2 ?

a) $b^2 = 274 - 98.595$ b) $b^2 = 64(0.4695)$ c) $b^2 = 274 - 49.294$
d) $b^2 = 225 + 49 - 210(.8829)$ e) none of these

3. In triangle ABC, $b = 77.5$, $c = 36.4$ and $B = 20.7^\circ$. Sin C =

a) $\sin C = 77.5/36.4 \sin 20.7^\circ$ b) $\sin C = \sin 20.7^\circ/(36.4)(77.5)$
c) $\sin C = 36.4 \sin 20.7^\circ/77.5$ d) $\sin C = 77.5 \sin 20.7^\circ/36.4$
e) none of these

4. In $\triangle ABC$, $c = 23$, $b = 27$, $a = 29$. Which expression equals the cosine of the largest angle?

a) $[(29)^2 + (27)^2 - (23)^2]/2(29)(27)$ b) $\{(29)^2 - [(27)^2+(23)^2]\}/2(27)(23)$
c) $[(27)^2 + (23)^2] - (29)^2 - 2(27)(23)$ d) $\{(27)^2 - [(23)^2 +(29)^2]\}/-2(23)(29)$
e) $[(27)^2 + (23)^2 - (29)^2]/2(27)(23)$

5. Given: $a = 6.0$, $b = 4.0$ and $B = 30^\circ$. How many triangle(s) are determined by the given data?

a) 0 b) 1 c) 2 d) 3 e) insufficient data to determine number of triangles

6. Given that $A = 40^\circ$, $B = 60^\circ$ and $C = 6.0$. Find b.

a) $b = 6.0 \sin 60^\circ/\sin 40^\circ$ b) $b = 6.0 \sin 40^\circ/\sin 60^\circ$
c) $b = 6.0 \sin 60^\circ/\sin 80^\circ$ d) $b = \sin 40^\circ/6.0 \sin 60^\circ$
e) $b = \sin 80^\circ/6.0 \sin 60^\circ$

7. Given: $a = 4.5$, $b = 6.0$, $A = 65^\circ$. How many triangle(s) are determined by the given data?

a) 0 b) 1 c) 2 d) 3 e) insufficient data to determine number of triangles

8. In triangle ABC, $c = 3.6$, $b = 2.9$ and $C = 69.4^\circ$. $A =$

a) 61.7° b) 36.3° c) 37.1° d) 48.9° e) 62.7°

9. In triangle ABC, a = 4.0, b = 4.5 and c = 6.7. Find B.

   a) 49.3° b) 42.2° c) 13.8° d) 40.7° e) none of these

10. In triangle ABC, A = 70°, B = 12° and b = 21.4. Find c.

    a) 4.5 b) 102.9 c) 97.9 d) 101.9 e) insufficient data

11. In triangle ABC, a = 13.2, b = 5.7, C = 67.6°. Determine c.

    a) 16.3 b) 13.3 c) 15.3 d) 14.4 e) 12.2

12. In triangle ABC, a = 3.9, b = 4.7 and c = 8.0. Find C.

    a) 90.0° b) 136.7° c) 100.0° d) 43.3° e) 133.3°

13. In triangle ABC, a = 5.2, c = 4.4 and C = 48.1°. Solve the triangle. A =

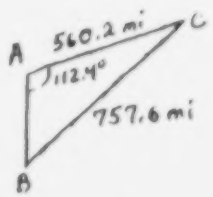
    a) 61.6° b) 39.0° c) 57.8° d) 61.6° or 118.4°
    e) 39.0° or 92.9°

14. Two points, A and B, are on opposite sides of an obstruction on a straight road. They are, respectively, 132 m and 98 m from a third point C off the road. In the triangle ABC, angle C = 112°. How far apart are the points A and B?

    a) 157 m b) 192 m c) 187 m d) 139 m e) 173 m

15. Find the distance from A to B in the diagram.

    a) insufficient data
    b) 923.0 mi.
    c) 353.0 mi.
    d) 553.2 mi.
    e) 339.8 mi.



16. In an isosceles triangle, the base angles each measure $34^\circ 30'$ and the base measures 12 in. Find the length of the other two sides.

    a) Both 12 in. b) Both 7.3 in. c) 12 in., 7.3 in.
    d) Both 19.8 in. e) 12 in., 19.8 in.

17. A triangular piece of land is bounded by 143 ft. of stone wall, 210 ft. of road frontage and 157 ft. of fencing. What angle does the fence make with the road?

    a) 48.4° b) 43.3° c) 42.9° d) 56.7° e) 88.7°

18. The sides of a parallelogram are 22 ft. and 34 ft. One of its angles measures 68°. Find the length of the shorter diagonal.

    a) 36.9 ft. b) 46.9 ft. c) 7.3 ft. d) 32.9 ft.
    e) insufficient data

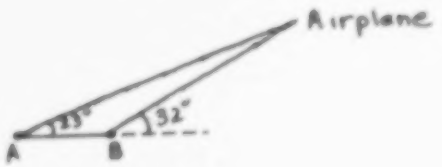
19. A guy wire to a pole makes a $57^{\circ}40'$ angle with level ground. At a point 7.6 m farther from the pole than the guy wire, the angle of elevation of the top of the pole is $39^{\circ}30'$. How long is the guy wire?

a) 15.5 m b) 3.9 m c) 19.8 m d) 6.3 m

e) it cannot be determined

20. The angles of elevation of an airplane, measured from points A and B, 574 ft. apart, are 23° and 32°. How far is point A from the airplane?

a) insufficient data
b) 371 ft.
c) 1,434 ft.
d) 624 ft.
e) 1,944 ft.



For questions #1 through #5, perform the indicated operations and express all answers in the form a + bj.

1. $(4 - 5j) - (-7 - j)$

   a) $11 - 4j$ b) $3 - 4j$ c) $-3 - 6j$ d) $11 - 6j$ e) none of these

2. $(7 - j) - (4 - 4j) + (6 - j)$

   a) $9 - 6j$ b) $17 - 6j$ c) $9 - 2j$ d) $9 + 2j$ e) $17 + 2j$

3. $(4 + \sqrt{-16}) + (3 - \sqrt{-81})$

   a) $7 - \sqrt{65}j$ b) $7 + 13j$ c) $7 - 5j$ d) $7 - 13j$ e) $7 - \sqrt{-65}$

4. $(2 - 3j)(7 + 5j)$

   a) $14 - 4j$ b) $29 - 11j$ c) $14 + 26j$ d) $14 - 26j$ e) $-1 - 11j$

5. $\dfrac{4 - j}{3 + 5j}$

   a) $\frac{7}{34} + \frac{23}{34}j$ b) $\frac{4}{3} - \frac{1}{5}j$ c) $-\frac{17}{34} + \frac{23}{34}j$ d) $-\frac{17}{16} + \frac{23}{16}j$

   e) $\frac{7}{34} - \frac{23}{34}j$

6. Simplify and select the answer that is <u>incorrect</u>: $\dfrac{3 + 2j}{4j}$

   a) $\dfrac{2 - 3j}{4}$ b) $-\frac{3}{4}j + \frac{1}{2}$ c) $\frac{3}{4} + \frac{1}{2}j$ d) $\frac{2}{4} - \frac{3}{4}j$ e) $\dfrac{1 - 1.5j}{2}$

7. Simplify: $j^9 - j^{15}$

   a) $-j$ b) -1 c) $2j$ d) 0 e) j^{-6}

8. Assume x and y are real numbers and solve for x and y: $2x - 3 - 7j = 12 + (6 + y)j$

   a) $x = 6$, $y = -19$ b) $x = \frac{15}{2}$, $y = -13$ c) $x = 9$, $y = 1$

   d) $x = \frac{15}{2}$, $y = 1$ e) none of these

9. Find a solution: $x^2 - 2x + 10 = 0$

   a) $2 + 6j$ b) $1 + 3j$ c) $1 + 6j$ d) $2 + 3j$ e) none of these

10. Find the reciprocal and express it in the form of a + bj: $3 + 2j$

    a) $\frac{3}{5} - \frac{2}{5}j$ b) $\frac{3}{5} + \frac{2}{5}j$ c) $\frac{3}{13} + \frac{2}{13}j$ d) $\frac{3}{13} - \frac{2}{13}j$

    e) none of these

11. Assume x and y are real numbers and solve for x and y: $2x + y + 2yj = 3 + 6j$, then $x + y$ will equal

    a) 6 b) 4 c) 3 d) 1 e) 0

12. Simplify: $\frac{4 - j}{6 + j} - \frac{2 - j}{6 + j}$

a) $\frac{10}{37} - \frac{14}{37} j$ b) $\frac{14}{37} - \frac{14}{37} j$ c) $\frac{12}{35} - \frac{2}{35} j$ d) $\frac{10}{35} + \frac{14}{35} j$

e) $\frac{12}{37} - \frac{2}{37} j$

13. Simplify: $j^{20} - j^{55} + j^{18} - j^{101}$

a) -1 b) j c) 0 d) 1 e) $-j$

14. Simplify: $(4 - 7j)^2$

a) $16 + 49j$ b) $-33 - 56j$ c) 65 d) $65 - 28j$ e) none of these

15. Simplify: $\frac{\sqrt{6} + 2j}{\sqrt{6} - 2j}$

a) $\frac{1}{2} + \frac{1}{2}\sqrt{6} j$ b) $\frac{1}{2} j - 2\sqrt{6} j$ c) $\frac{1}{5} + \frac{1}{5}\sqrt{6} j$ d) $\frac{1}{5} + \frac{2}{5}\sqrt{6} j$

e) $1 - j$

For questions #16 through #20, express the given complex numbers in polar form ($0^\circ \leq \theta < 360^\circ$).

16. $-2j$

a) $-2 \text{ cis } 270^\circ$ b) $-2 \text{ cis } 90^\circ$ c) $2 \text{ cis } 180^\circ$ d) $2 \text{ cis } 270^\circ$

e) $2 \text{ cis } 90^\circ$

17. -3

a) $-3 \text{ cis } 0^\circ$ b) $-3 \text{ cis } 90^\circ$ c) $-3 \text{ cis } 180^\circ$ d) $-3 \text{ cis } 270^\circ$

e) none of these

18. $2 - 2j$

a) $2\sqrt{2} \text{ cis } 315^\circ$ b) $2 \text{ cis } 315^\circ$ c) $2 \text{ cis } 225^\circ$ d) $2\sqrt{2} \text{ cis } 135^\circ$

e) $2 \text{ cis } 225^\circ$

19. $-\sqrt{3} - j$

a) $\sqrt{3} \text{ cis } 30^\circ$ b) $2 \text{ cis } 210^\circ$ c) $2 \text{ cis } 150^\circ$ d) $\sqrt{3} \text{ cis } 210^\circ$

e) $\sqrt{3} \text{ cis } 330^\circ$

20. $-4 + 3j$

a) $5 \text{ cis } 37^\circ$ b) $-5 \text{ cis } 37^\circ$ c) $5 \text{ cis } 143^\circ$ d) $5 \text{ cis } 217^\circ$

e) $5 \text{ cis } 323^\circ$

Express the given complex numbers in rectangular form.

21. $2 \text{ cis } 150^\circ$

a) $\frac{1}{2} - \frac{\sqrt{3}}{2} j$ b) $-\sqrt{3} + j$ c) $1 - \sqrt{3} j$ d) $1 + \sqrt{3} j$ e) $\sqrt{3} + j$

22. $6 \text{ cis } 240^\circ$

a) $-3 - 3\sqrt{3} j$ b) $-\frac{3}{6} - \frac{\sqrt{3}}{6} j$ c) $1 - \sqrt{3} j$ d) $-1 - \sqrt{3} j$

e) $1 + \sqrt{3} j$

23. $4 \text{ cis } 315^\circ$

a) $\sqrt{2} - \sqrt{2} j$ b) $-\sqrt{2} - \sqrt{2} j$ c) $-2\sqrt{2} - 2\sqrt{2} j$ d) $2\sqrt{2} - 2\sqrt{2} j$

e) $\sqrt{2} - 2\sqrt{2} j$

24. $2.00 \text{ cis } 27^\circ$

a) $.91 + 1.78j$ b) $1.78 + .91j$ c) $.89 + .45j$ d) $-.91 - 1.78j$

e) $.45 + .89j$

25. $4.1 \text{ cis } 146^\circ$

a) $-3.4 + 2.3j$ b) $-.8 + .7j$ c) $.7 - .8j$ d) $-2.3 + 3.4j$

e) $-.7 + .8j$

MATH 3320 - MODULE 8

1. Determine the degree of the polynomial $5x^3 - 2x + \sqrt{3}$

   a) 0 b) 1 c) 2 d) 3 e) 4

2. The degree of the polynomial $\pi^2 - 5x + 4$ is

   a) 0 b) 1 c) 2 d) 3 e) 4

3. Determine whether -4, -2 and 2 are roots of $P(x) = 3x^3 + 10x^2 - 16x - 32$

   a) -4, -2 and 2 are roots
   b) -4 and -2 are roots; 2 is not a root
   c) -4 and 2 are roots; -2 is not a root
   d) -2 and 2 are roots; -4 is not a root
   e) -4 is a root; -2 and 2 are not roots

4. Find P(-3). $P(x) = x^5 + 4x^2 - 2x + 7$

   a) 22 b) -194 c) 130 d) 64 e) 108

5. Find $f(-\frac{1}{3})$. $f(x) = 9x^4 - 7x^2 + x + 4$

   a) 3 b) $\frac{1}{3}$ c) $-\frac{1}{3}$ d) -3 e) $3\frac{2}{3}$

6. Given $P(x) = x^3 + x + 2$ then a root of P(x) is

   a) $\frac{1}{2}$ b) 0 c) -2 d) 1 e) -1

7. Given $f(x) = x^3 - x^2 + 2x + 4$ then a root of f(x) is

   a) -2 b) 2 c) 0 d) 1 e) -1

8. Find the quotient and remainder when $8x^3 - 12x^2 + 4x - 2$ is divided by $4x - 2$

   a) $2x^2 - 2x$, R = 0 b) $8x^3 - 12x^2$, R = 0 c) $2x^2 - 4x + \frac{1}{2}$, R = -1

   d) $2x^2 - 2x$, R = -2 e) $2x^2 - 4x + 3$, R = -8

9. Find the quotient and remainder when $-2x^2 + x + 5$ is divided by $2x + 3$

   a) $-x + 2$, R = -1 b) $-x + 2$, R = 11 c) $x + 1$, R = 2

   d) $x - 1$, R = 2 e) $x + 2$, R = -1

10. Find the quotient and remainder when $2x^2 + x + 1$ is divided by $4x - 6$

    a) $\frac{1}{2}x + 1$, R = -7 b) $\frac{1}{2}x + 1$, R = -5 c) $\frac{1}{2}x - \frac{1}{2}$, R = 4

    d) $\frac{1}{2}x + \frac{1}{2}$, R = -2 e) $\frac{1}{2}x + 1$, R = 7

11. Find the remainder when $21x^3 + 14x + 6$ is divided by $x + 2$

    a) 146 b) 62 c) -190 d) 202 e) none of these

12. For $P(x) = x^3 + 2x^2 - x - 2$, which of the following are factors of $P(x)$?

i. $x + 1$ ii. $x - 2$ iii. $x + 2$

a) i b) ii c) i and ii d) i and iii e) i, ii and iii

13. For $P(x) = x^3 + 2x^2 - 5x - 6$, which of the following are factors of $P(x)$?

i. $x + 2$ ii. $x - 3$ iii. $x^2 + x - 6$

a) i b) ii c) iii d) i, ii and iii e) ii and iii

14. Find the remainder: $(3x^3 - 8x^2 - x + 12) \div (x^2 - x - 2)$

a) 0 b) 2 c) -6 d) $4x + 34$ e) $-6x + 2$

15. Given $f(x) = 2x + 3$. When we divide $f(x)$ by $-x + 4$, the quotient is -2 and the remainder is 11. Which one of the following statements is <u>false</u>?

a) $2x + 3 = -2(-x + 4) + 11$ b) $f(4) = 11$ c) $\frac{2x + 3}{-x + 4} = -2 + \frac{11}{-x + 4}$

d) $\frac{2x + 3}{-x + 4} = -2 - \frac{11}{-x + 4}$ e) $-\frac{3}{2}$ is a root of $f(x)$

16. Given $f(x) = 3x^2 + x - 1$. When we divide $f(x)$ by $x + 2$, the quotient is $3x - 5$ and the remainder is 9. Which one of the following statements is <u>false</u>?

a) $3x^2 + x - 1 = (x + 2)(3x - 5) + 9$ b) $\frac{3x^2 + x - 1}{x + 2} = (3x - 5) + \frac{9}{x + 2}$

c) $\frac{3x^2 + x - 1}{x + 2} = 3x - 5 + 9$ d) $f(-2) = 9$ e) -2 <u>is not</u> a root of $f(x) = 0$

17. $\frac{6!}{2!\ 3!} =$

a) 60 b) 2 c) 1 d) $\frac{6}{5}$ e) 30

18. In expanding the binomial $(a + b)^{10}$, the exponent of b in the seventh term is

a) 3 b) 5 c) 7 d) 9 e) none of these

19. Find the third term of $(2a - b)^8$

a) $-1792a^6b^2$ b) $256a^8b^8$ c) $1792a^6b^2$ d) $56a^2b^6$ e) $-320a^5b^3$

20. Find the middle term of $(x + \frac{1}{2}y)^6$

a) $\frac{5}{2}x^3y^3$ b) $10x^3y^3$ c) $\frac{15}{4}x^4y^2$ d) $\frac{15}{2}x^4y^2$ e) $\frac{15}{16}x^2y^4$

21. Expand: $(3x - y)^4$

a) $81x^4 + y^4$ b) $81x^4 - 108x^3y + 54x^2y^2 - 12xy^3 + y^4$

c) $3x^4 - 12x^3y + 18x^2y^2 - 12xy^3 + y^4$ d) $3x^4 + y^4$ e) $81x^4 - y^4$

22. Find the 5th term of $(4 + \sqrt{x})^7$

a) $64x^2$ b) $35x^{5/2}$ c) $2240x^2$ d) $64\sqrt{x}$ e) $21504x$

23. Expand $(a + b^2)^3$

a) $a^3 + b^6$ b) $a^3 + 3a^2b + 6ab^2 + b^3$ c) $a^3 + 3a^2b + 3ab^2 + b^3$
d) $a^3 + 3a^2b^2 + 3ab^4 + b^6$ e) $a^3 + b^5$

24. Find the 2nd term of $(x^2 + \sqrt{3})^5$

a) $5\sqrt{3}\,x^2$ b) $\sqrt{3}\,x^8$ c) $5\sqrt{3}\,x^8$ d) $5\sqrt{3}\,x^4$ e) $90x^6$

25. In expanding $(x - \frac{1}{y})^5$, the coefficient of $\frac{x^2}{y^3}$ is

a) 5 b) -5 c) 10 d) -10 e) $-\frac{5}{3}$

MATH 3320 - MODULE 9

Work questions #1 through #5 using synthetic division.

1. Determine the quotient and remainder: $(2x^3 + 3x^2 - 5x - 6) \div (x + 2)$

   a) $2x^2 + 7x + 9$, R = 12 b) $2x^2 - x - 3$, R = 0 c) $2x^3 - x^2 - 3x$, R = 0

   d) $2x - 1$, R = -3 e) $2x^3 + 7x^2 + 9x + 12$, R = 0

2. Determine the quotient: $(x^3 - 1) \div (x - 1)$

   a) x^2 b) $x^2 - 2x$ c) $x^2 - x + 1$ d) $x^2 + x + 1$ e) $x^2 + 1$

3. Determine which of the following are factors of $P(x) = 2x^3 - 5x^2 - x + 6$

   i. $x - 2$ ii. $x + 2$ iii. $x + 1$

   a) i b) i and ii c) iii d) ii and iii e) i and iii

4. Given $f(x) = 2x^3 - 2x^2 + x + 1$, find $f(r)$ for $r = \frac{1}{2}$

   a) 1 b) $\frac{5}{4}$ c) $\frac{9}{4}$ d) $-\frac{1}{4}$ e) $\frac{7}{4}$

5. Determine which of the following are zeroes of $P(x) = x^3 + 4x^2 + 8x + 8$

   i. -2 ii. 2 iii. -4

   a) i b) ii c) iii d) i and ii e) ii and iii

Use $P(x) = (2x^2 - 5x - 3)(x + 1)^2$ for questions #6 and #7.

6. State the degree of the polynomial

   a) 2 b) 3 c) 4 d) 5 e) none of these

7. Find all roots with multiplicity of the polynomial

   a) $-1, -\frac{1}{2}, 3$ b) $-3, 1, \frac{1}{2}$ c) 1(multiplicity 2), $-\frac{1}{2}$, 3

   d) -3, -1(multiplicity 2), $\frac{1}{2}$ e) -1(multiplicity 2), $-\frac{1}{2}$, 3

8. Find the zeros, with multiplicity, of the polynomial function, $P(x) = 2x(3x^2 - 2x - 5)^2(x - 2)$

   a) -1(multiplicity 2), 0, $\frac{5}{3}$(multiplicity 2), 2 b) $-1, 0, \frac{5}{3}, 2$

   c) -1(multiplicity 2), $\frac{5}{3}$(multiplicity 2), 2

   d) $-\frac{5}{3}$(multiplicity 2), 1(multiplicity 2), 2 e) none of these

Use the quadratic formula to solve the equations in questions #9 and #10. Simplify answers.

9. $3x^2 - 2x - 7 = 0$

   a) $\frac{1 \pm \sqrt{22}}{3}$ b) $\frac{-1 \pm \sqrt{22}}{3}$ c) $\frac{1 \pm \sqrt{88}}{3}$ d) $\frac{1 \pm 2\sqrt{22}}{3}$ e) none of these

10. $3x^2 = 6x - 2$

a) $\pm 2\sqrt{3}$ b) $\frac{3 \pm \sqrt{3}}{3}$ c) $\frac{6 \pm \sqrt{12}}{6}$ d) $1 \pm \sqrt{12}$ e) none of these

In questions #11 through #14, you are given a polynomial and one or more roots. Determine the remaining roots.

11. $x^3 - 4x^2 + x + 6$; 2

a) -3, 1 b) -3, -1 c) 3, 1 d) 3, -1 e) none of these

12. $x^3 + 3x^2 - 2$; -1

a) 2, -1 b) 1, -2 c) $-1 \pm \sqrt{3}$ d) $\pm \sqrt{3}$ e) none of these

13. $2x^3 - 3x^2 + 8x - 12$; $\frac{3}{2}$

a) ± 2 b) 2 (double root) c) -2 (double root)

d) 2j (double root) e) $\pm 2j$

14. $x^4 + 2x^3 - 3x^2 - 8x - 4$; 2, -2

a) 1, -1 b) 1 (double root) c) -1 (double root)

d) 1, 2 (double root) e) none of these

15. A third degree equation with real coefficients has roots 1 + j and -2. What is the third root?

a) 2 b) -1 + j c) -1 - j d) 1 + j e) none of these

16. A fourth degree polynomial with real coefficients has zeros 2j and 1 - 3j . What are the other two zeros ?

a) 2j and 1 - 3j b) -2j and 1 - 3j c) -2j and 1 + 3j

d) 2j and 1 + 3j e) none of these

For questions #17 and #18, list all of the possible rational roots of the following equations.

17. $x^3 - 7x + 6 = 0$

a) $\pm$ (1,2) b) $\pm$ (1,2,3,6) c) $\pm$ (1,2,3,4) d) $\pm$ (1,2,3)

e) none of these

18. $4x^3 - 25x^2 - 8 = 0$

a) $\pm$ (1,2,4,8) b) $\pm$ (1,2,4) c) $\pm$ (1,2,8) d) $\pm$ ($\frac{1}{4}$,$\frac{1}{2}$,1,2,4,8)

e) none of these

For questions #19 through #22, first solve the given equation completely. Then, answer the given question relating to the solutions of the equation.

19. Solve the equation $x^3 + x^2 - 10x + 8 = 0$ and find the sum of the roots.

a) 1 b) 2 c) 3 d) -1 e) -3

20. Given the equation: $x^3 + x^2 = x + 1$

a) there is just one solution
b) there are two solutions, both negative
c) there are three distinct solutions
d) there are two solutions, both positive
e) none of these

21. Given the equation, $x^3 - 4x^2 + x + 6 = 0$, the roots all lie between

a) -7 and -3 b) -5 and 2 c) 0 and 4 d) -2 and 4
e) none of these

22. Given the equation, $x^4 + 5x^3 + 5x^2 - 5x - 6 = 0$, the roots all lie between

a) -2 and 2 b) -2 and 4 c) -4 and 2 d) -4 and 0
e) none of these

Use this equation for questions #23 and #24: $2x^4 - 5x^3 - 3x^2 + 4x + 2 = 0$

23. The possible rational roots of this equation are:

a) $\pm$ (1,2) b) $\pm$ (1,2,4) c) $\pm$ (1,2,$\frac{1}{2}$,$\frac{1}{4}$) d) $\pm$ (1,2,$\frac{1}{2}$)
e) none of these

24. The roots of this equation are:

a) all rational b) all irrational c) rational and complex
d) rational and irrational e) all complex

25. Solve completely: $x^3 - 1 = 0$

a) $1, \frac{-1 \pm j\sqrt{3}}{2}$ b) $1, \frac{1 \pm j\sqrt{3}}{2}$ c) $1, 1 \pm j$ d) $-1, \frac{-1 \pm j\sqrt{3}}{2}$
e) none of these

1. Solve: $5y - 5 + y \leq 2 - 6y - 8$

   a) $y \geq -\frac{1}{12}$ b) $y \geq -12$ c) $y \leq -12$ d) $y \leq -\frac{1}{12}$

   e) there is no solution

2. Solve: $2 - (5 - 3x) < 6$

   a) $\{x \mid x < 3\}$ b) $\{x \mid x < -3\}$ c) $\{x \mid x < 1\}$ d) $\{x \mid x > -1\}$
   e) $\{x \mid x > -3\}$

3. Solve: $1 - 3x > 5 + 2x$

   a) $\{x \mid x > 1.2\}$ b) $\{x \mid x > -1.2\}$ c) $\{x \mid x < -\frac{4}{5}\}$ d) $\{x \mid x < -4\}$
   e) $\{x \mid x < \frac{4}{5}\}$

4. Solve: $-10(x - 2) \geq 2x + 8$

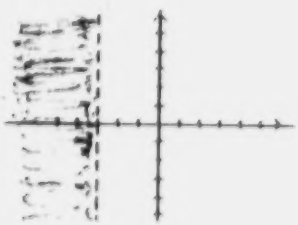
   a) $x \leq -\frac{7}{3}$ b) $x \leq -\frac{1}{2}$ c) $x \leq \frac{3}{2}$ d) $x \geq 1$ e) none of these

5. Solve: $\frac{1}{6}x - \frac{3}{4} < \frac{3}{8}x - 2$

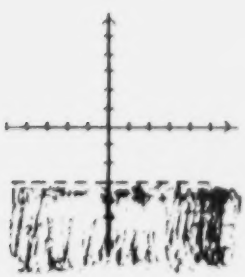
   a) $x < 6$ b) $x > -\frac{16}{5}$ c) $x > \frac{66}{5}$ d) $x < -\frac{16}{5}$ e) $x > 6$

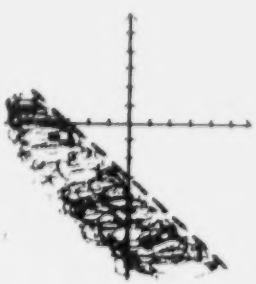
6. Graph: $x < -3$

   a)

   b) 

   c)

   d) 

   e) 

7. Graph: $2y - x \geq 2$

   a)

   b)

   c)

   d)

   e) none of these

8. Write interval notation for $\{x \mid 0 \leq x < \frac{5}{3}\}$

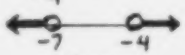
a) $(0,\frac{5}{3})$ b) $(0,\frac{5}{3}]$ c) $[0,\frac{5}{3})$ d) $[0,\frac{5}{3}]$ e) none of these

9. Graph: $\{x \mid x > -4\} \cup \{x \mid x > -7\}$

a)

b)

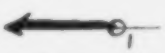
c)

d) 

e) none of these

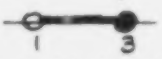
10. Graph: $\{x \mid 1 < x\} \cap \{x \mid x \leq 3\}$

a)

b) 

c)

d)

e) 

11. Which of the following inequalities is not satisfied by any number?

a) $-4 < x < 0$ b) $4 \geq x > -3$ c) $7 < x < 5$ d) $-2 \leq x \leq -\frac{1}{2}$

e) they are all valid

12. Solve: $(x - 4)(x - 7) \geq 0$

a) $4 \leq x \leq 7$ b) $x \geq 4$ or $x \geq 7$ c) $x \leq 4$ d) $x \geq 7$

e) none of these

13. Solve: $x^2 - 8x + 15 < 0$

a) $3 < x < 5$ b) $-5 < x < -3$ c) $x < 5$ d) $x > 3$

e) $x > 3$ or $x < 5$

14. Solve: $x^2 - 3x \geq 0$

a) $x \geq 3$ b) $x \leq 0$ c) $x \leq 0$ or $x \geq 3$ d) $0 \leq x \leq 3$ e) $x \leq 3$

15. Solve: $x^2 + 4x + 2 < 0$

a) no real numbers b) all real numbers c) $2 - \sqrt{2} < x < 2 + \sqrt{2}$

d) $x < -2 - \sqrt{2}$ or $x > -2 + \sqrt{2}$ e) $-2 - \sqrt{2} < x < -2 + \sqrt{2}$

16. Solve: $\frac{x - 1}{2 - x} \geq 0$

a) $-2 < x < -1$ b) $x \leq 1$ or $x > 2$ c) $1 \leq x < 2$

d) $x > -1$ or $x < -2$ e) $1 \leq x \leq 2$

17. Solve: $(x + 3)^2 < 0$

a) $x < 3$ b) $-3 < x < 3$ c) $x < -3$ d) all real numbers

e) no real numbers

18. Solve: $x^2 + 4x - 12 \geq 0$

a) $[-6,2]$ b) $\{x \mid -6 \leq x \leq 2\}$ c) $\{x \mid x \leq -6\} \cup \{x \mid x \geq 2\}$
d) $\{x \mid -6 \leq x \leq 2\}$ e) $\{x \mid x \leq -6\} \cap \{x \mid x \geq 2\}$

19. Solve: $\frac{1 - 6x}{3x} < 0$

a) $2 < 5$ b) $0 < x < \frac{1}{6}$ c) $x > \frac{1}{6}$ d) all real numbers
e) $x < 0$ or $x > \frac{1}{6}$

20. $(x + 1)(x - 2)(x - 5) > 0$

a) $\{x \mid -1 < x < 2$ or $x > 5\}$ b) $x^3 - 6x^2 + 3x + 10 > 0$
c) all real numbers d) $\{x \mid x < -1$ or $2 < x < 5\}$ e) $\{x \mid x > 5\}$

21. Solve: $\frac{x - 1}{x + 3} > 2$

a) $-3 < x < 5$ b) $x < -7$ or $x > -3$ c) $x < -3$ or $x > 5$
d) $x < -4$ e) $-7 < x < -3$

22. Solve: $2x^2 + x + 1 > 0$

a) no real numbers b) $x > -7$ c) all real numbers
d) $x < \frac{-1 - \sqrt{-7}}{4}$ or $x > \frac{-1 + \sqrt{-7}}{4}$ e) $\frac{-1 - \sqrt{-7}}{4} < x < \frac{-1 + \sqrt{-7}}{4}$

23. Solve: $\frac{(x - 4)(2x + 1)}{x + 2} < 0$

a) $x < -2$ b) $x < -2$ or $-\frac{1}{2} < x < 4$ c) $x < 4$
d) $-2 < x < -\frac{1}{2}$ or $x > 4$ e) none of these

24. Solve: $2x^2 + 9x - 5 \geq 0$

a) $[-5,\frac{1}{2}]$ b) $\{x \mid x \leq -5$ or $x \geq \frac{1}{2}\}$ c) $\{x \mid x \geq \frac{1}{2}\}$
d) $\{x \mid -5 < x < \frac{1}{2}\}$ e) no real numbers

25. Solve: $x^2 - 12x + 36 \geq 0$

a) $x \leq 6$ b) $-6 \leq x \leq 6$ c) $x \leq -6$ d) all real numbers
e) no real numbers

MATH 3320 - MODULE 11

1. Solve: $|5 - x| < 3$

a) $-8 < x < -2$ b) $2 < x < 8$ c) $x < 2$ or $x > 8$
d) $x > -2$ or $x > -8$ e) no solution

2. Solve: $|2x - 3| < 7$

a) $x < 5$ b) $-5 < x < 2$ c) $x < -2$ or $x > 5$
d) $-2 < x < 5$ e) none of these

3. Solve: $\left|\frac{x}{3} - 2\right| > 3$

a) $x < -3$ or $x > 15$ b) $x < -9$ or $x > 11$ c) $-3 < x < 15$
d) $x > 15$ e) $x > 11$

4. Solve: $|-2x + 3| \geq 7$

a) $-2 \leq x \leq 5$ b) $x \leq -2$ c) $x \leq 2$ d) $x \leq -5$ or $x \geq 1$
e) $x \leq -2$ or $x \geq 5$

5. Solve: $|8 - 2x| \leq -4$

a) $x \geq 6$ b) $-2 \leq x \leq 6$ c) $x \leq 6$ d) $x \leq 2$ or $x \geq 6$
e) no solution

6. Simplify: $(4^0a^2b^{-2})^2$

a) $\frac{a^4}{b^4}$ b) $16a^4b^4$ c) $\frac{16a^4}{b^4}$ d) a^4b^4 e) $\frac{16a^4}{b^{-4}}$

7. Simplify: $(8a^6)^{-1/3}$

a) $2a^3$ b) $2a^2$ c) $\frac{1}{2a^3}$ d) $\frac{1}{2a^2}$ e) $\frac{1}{512a^{18}}$

8. Simplify: $\left(\frac{5b^2}{2a}\right)^{-3}$

a) $-\frac{125b^6}{8a^3}$ b) $\sqrt[3]{\frac{5b^2}{2a}}$ c) $\frac{8a^3}{125b^6}$ d) $-\sqrt[3]{\frac{5b^2}{2a}}$ e) $-\frac{15b^6}{6a^3}$

9. Simplify: $(36a^8)^{\frac{1}{2}}$

a) $6a^4$ b) $18a^4$ c) $6a^{\sqrt{8}}$ d) $\frac{1}{36^2a^{16}}$ e) $36a^4$

10. Write a logarithmic equation equivalent to $y = b^2$

a) $\log_2 y = b$ b) $\log_b 2 = y$ c) $\log_b y = 2$ d) $\log_b y^2 = 2$
e) $\log_y 2 = b$

11. Write an exponential equation equivalent to $\log_e 7.39 = 2$

a) $7.39^e = 2$ b) $\frac{2}{e} = 7.39$ c) $2^e = 7.39$ d) $e^{7.39} = 2$

e) $e^2 = 7.39$

12. $\log_{16} 4 =$

a) -2 b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{1}{8}$ e) 2

13. $\log_2 \sqrt[5]{2} =$

a) -5 b) $\frac{1}{5}$ c) 5 d) $2^{1/5}$ e) $-\frac{1}{5}$

14. Solve for b: $\log_b 400 = 2$

a) ± 20 b) 160,000 c) 800 d) 200 e) 20

15. Solve for x: $\log_{10} \frac{1}{x^2} = -2$

a) $\pm \frac{\sqrt{5}}{10}$ b) 10 c) $\pm \frac{1}{10}$ d) ± 10 e) no real solutions

16. Which of the following is undefined?

a) $\log_3 1$ b) $\log_3 5$ c) $\log_3 \sqrt[3]{4}$ d) $\log_3 \frac{1}{5}$ e) $\log_3 0$

In questions #17 through #22, solve for x.

17. $\log_4 16 = x$

a) 4 b) 2 c) 12 d) -2 e) $\frac{1}{2}$

18. $\log_7 x = -2$

a) 49 b) 128 c) -49 d) $\frac{1}{49}$ e) no solution

19. $\log_x 4 = \frac{2}{3}$

a) 2 b) 4 c) 6 d) 8 e) 16

20. $\log_{16}(\frac{1}{4}) = x$

a) 2 b) -2 c) $\frac{1}{2}$ d) $-\frac{1}{2}$ e) no solution

21. Simplify: $\log_e e^{(x^2 + 9)}$

a) $\frac{x^2 + 9}{e}$ b) $9x^2$ c) $\log_e x^2 + \log_e 9$ d) $\log_e(x^2 + 9)$ e) $x^2 + 9$

22. Which of the following could be the graph of $y = 2^x$?

a)

b)

c)

d)

e)

23. Find the domain of the function $f(x) = \log_3 x$

a) all real numbers b) $x \geq 0$ c) $x > 0$ d) $x \neq 0$ e) $x > 1$

24. Solve for x: $\log_5(x - 1) = 0$

a) 2 b) 0 c) 1 d) 5 e) 3

25. Which of the following is an x-intercept of the graph $f(x) = \log_5 x - 1$

a) 5 b) 1 c) -5 d) $\frac{1}{5}$ e) no x-intercept

For questions #1 and #2, simplify the given expressions using $\log_b x = r$, $\log_b y = s$ and $\log_b z = t$.

1. $\log_b x^5 =$

   a) $5 \log_b r$ b) $5r$ c) r^5 d) 5 e) $\frac{r^5}{b}$

2. $\log_b\left(\frac{x}{y^2}\right) =$

   a) $\log_b r - 2 \log_b s$ b) $r - s^2$ c) $r - 2s$ d) $\frac{r}{2s}$ e) $\frac{r}{s^2}$

3. $\log_b \frac{x\sqrt[3]{y}}{z^7} =$

   a) $3 \log_b r + \frac{1}{2} \log_b s - 7 \log_b 7$ b) $r^3 + \sqrt{s} - t^3$ c) $\frac{3r + \frac{1}{2} s}{t^7}$

   d) $3r + \frac{1}{2} s - 7t$ e) none of these

For questions #4 through #6, evaluate the given logarithm (to four decimal places), using $\log_b 2 = .6309$, $\log_b 5 = 1.4650$ and $\log_b 7 = 1.7712$.

4. $\log_b 20$

   a) 6.309 b) 1.8485 c) 2.7268 d) 0.5831 e) 4.1919

5. $\log_b \sqrt{7}$

   a) 1.7712 b) 0.8856 c) -3.5424 d) 1.3309 e) 2.6458

6. $\log_b 0.01$ (Hint: write as a fraction)

   a) -2.0959 b) -1.0959 c) $\frac{1}{4.1918}$ d) -4.1918 e) 0.2096

7. Which one of the following statements is <u>false</u> ?

   a) $\log_b 50 = 2 \log_b 5 + \log_b 2$ b) $\log_b\left(\frac{1}{81}\right) = -4 \log_b 3$

   c) $\log_b \sqrt{5} = \frac{1}{2} \log_b 5$ d) $9^{\log_3 9} = 3$ e) $\log_2(8^n) = 3n$

Express as a single logarithm and simplify if possible.

8. $2 \log_b x - \frac{1}{3} \log_b y$

   a) $\log_b\left(\frac{x^2}{3y}\right)$ b) $\log_b\left(\frac{x^2}{\sqrt[3]{y}}\right)$ c) $\log_b\left(\frac{3x^2}{y}\right)$ d) $\log_b(2x - \frac{y}{3})$

   e) $\log_b(x^2 - \sqrt[3]{y})$

9. $\log_b(x^2 + 3x - 18) - \log_b(x - 3)$

a) $\log_b(x^2 + 2x - 15)$ b) $\log_b(x^2 + 2x - 21)$ c) $\log_b(x^3 - 27x + 54)$

d) $\log_b(x + 6)$ e) $\log_b x + \log_b 6$

10. $\frac{1}{3}\log x - 2\log y - 3\log z$

a) $\log \frac{\sqrt[3]{x}}{y^2 z^3}$ b) $\log(\sqrt[3]{x} - y^2 - z^3)$ c) $\log \frac{\sqrt[3]{xz}}{y^2}$ d) $\log\left(\frac{\sqrt[3]{x}\, y^2}{z^3}\right)$

e) $\log(\sqrt[3]{x}\, y^2 z^3)$

11. Solve: $\log x = 3.4048$, then $x =$

a) 2.54 b) 0.5315 c) 2540 d) 5.54 e) 5540

12. Find the value of $\log\left(\frac{790}{8.02}\right)$

a) 98.5037 b) 1.9934 c) 3.2047 d) 0.3613 e) none of these

13. Find log 0.000566

a) -3.2472 b) 0.7528 c) 2.7528 d) 3.2472 e) -4.2472

14. Find: $\log \sqrt[3]{38310000}$

a) 337.1 b) 1.8741 c) 2.5278 d) 22.7499 e) none of these

For questions #15 and #16, use a calculator to find the indicated logarithms to four decimal places.

15. $\log_2 86$

a) 1.9345 b) 0.9672 c) 3.8690 d) 6.4263 e) 3.5003

16. ln 1.56

a) 0.1931 b) 0.5739 c) 0.4447 d) 0.0710 e) 0.0839

Solve the following questions for x.

17. $\log_2(x^2 + 6x) = 4$

a) $-3 \pm \sqrt{13}$ b) -8,2 c) 2 d) $-3 \pm \sqrt{17}$ e) no real solutions

18. $\log_5(x - 3) + \log_5 x = \log_5 4$

a) 1 b) 2 c) 3 d) 4 e) 5

19. $\log_5 25^{(x-3)} = 2$

a) 2 b) 4 c) 6 d) 8 e) 10

20. $\log_{10}(x - 2) = 2$

a) 2 b) -2 c) 102 d) 98 e) none of these

21. $\log x + \log (x - 3) = 1$

a) 7 b) 5 c) -5 d) 3 e) 2

22. $5^x = 4$

a) 0.80 b) 1.25 c) 1.16 d) -0.80 e) 0.861

23. $3^{x+2} = 1$

a) -2 b) -1 c) 2 d) -4 e) none of these

24. $3^x = \frac{1}{81}$

a) -0.241 b) -0.4 c) -4 d) -5.2 e) -7.8

25. $6^{x+1} = 10$

a) 1.2 b) 1 c) 1.66 d) 0.285 e) 0.66

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